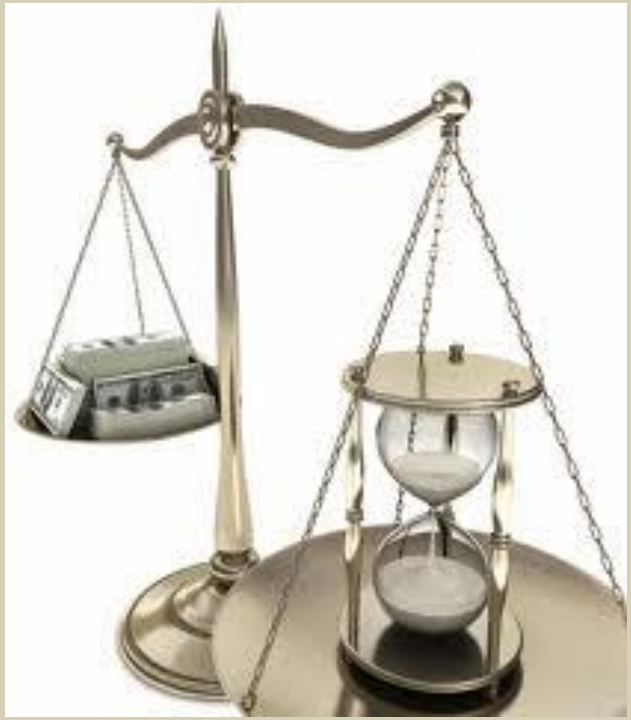
Time Value of Money

Functional Calculation, Some examples



Brought to you by: UCSI 1 CARD

Source Supported by:
Assistant Professor Frankie Goh Song Peng
Faculty of Business Technology and Information Science (FoBIS),
UCSI University

The Role of "Time Value" in Finance

- In Finance, the timing of cash outflows and cash inflows has important economic consequences, which financial managers explicitly recognized it as the "Time Value of Money." It is the most important concept in Accounting and Finance, and the basis of many financial instruments, including insurance and mutual funds…

"A dollar today is worth more than a dollar tomorrow"

Future Value vs. Present Value

- Because money has time value, all of the cash flows associated with an investment must be measured at the same point in time.
- The acts of *compounding* and *discounting* in determining the future value and present value respectively, are the ways to standardized the timeline for each period.

Future value: compounding
Present value: discounting

Formulas for calculating Future Value and Present Value

- Future Value(FV) of *n* periods

$$FV_n = PV_0(1+i)^n$$

Where:

FV_n = future value after n periods

PV_0 = the amount of cash or funds available in hand **today**

i = annual rate of interest paid

n = number of compounding periods

Formulas for calculating Future Value and Present Value

- Present Value (PV) of *n* periods

$$PV_0 = \frac{FV_n}{(1+i)^n}$$

Where:

FV_n = future value after n periods

PV_0 = the amount of cash or funds should be available in hand **today**

i = annual rate of interest paid

n = number of compounding periods

Annuities

- Annuity can be defined as a series of equal payments that are made at the end of equidistant points in time such as monthly, quarterly, or annually over a finite period of time, for instance, 3 years.

- Payments of annuity can either be made at the beginning or at the end of each period.

Annuities

- **Ordinary Annuity:** Payments are made at the end of each period.

  Example: Straight bonds coupon payments made every end of period

- **Annuity Due:** Payments are made at the beginning of each period.

  Example: Property leasing payment (or rental payment)

FORMULAS AND TVM TABLES APPROACH

Ordinary Annuity

- The Future Value of Ordinary Annuity

$$FV_5 = PMT\left[\frac{(1+i)^n - 1}{i}\right] or, PMT\,(FVIFA_{6\%,5})$$

FORMULAS AND TVM TABLES APPROACH

Ordinary Annuity

- The Present Value of Ordinary Annuity

$$PV_5 = PMT \frac{\left[1 - \frac{1}{(1+i)^n}\right]}{i} or, PMT\,(PVIFA_{6\%,5})$$

Practical Loan Balance Calculation using Time Value of Money:

Su Ting purchased a RM15,000 car three years ago using an 8 percent, 4-year loan. She has decided that she would sell the car now, if she could get a price that would pay off the balance of her loan. What is the minimum price Su Ting would need to receive for her car?

First calculate the monthly payment that she has been paying:

$$PMT_{48} = \$15{,}000 \times \left[\frac{0.08/12}{1 - \frac{1}{(1+0.08/12)^{48}}} \right] = \$366.19$$

The loan balance is the principal amount outstanding. The duration of remaining payments is 12, the interest rate is 8 percent annual and the monthly payment is RM366.19 from the previous calculation.

$$PVA = \$366.19 \times \left[\frac{1 - \frac{1}{(1+0.08/12)^{12}}}{0.08/12} \right] = \$4{,}209.64$$

This is the minimum price the car needs to be sold for and it represents her break even price.

Investing for Retirement:

CK has decided that he wants to build enough retirement wealth that, if invested at 7 percent per year, will provide him with RM3,000 of monthly income for 30 years. To date, he has saved nothing, but he still has 20 years until he retires. How much money does he need to contribute per month to reach his goal?

First, calculate the amount you would need to have in 20 years time to yield the $3,000 monthly payments for an additional 30 years:

$$PVA = \$3{,}000 \times \left[\frac{1 - \frac{1}{(1 + 0.07/12)^{360}}}{0.07/12} \right] = \$450{,}922.70$$

This amount will become the future value in the next calculation, assuming 7 percent interest and 240 level monthly payments:

$$\$450{,}922.70 = PMT \times \frac{(1 + 0.07/12)^{240} - 1}{0.07/12} \Rightarrow PMT = \$865.62$$

In summary, Time Value of Money is a very powerful financial concept.

It is also the foundation of many financial instruments.

Learn it well and it will help you enormously when planning for future financial commitment.

UCSI 1 CARD

UCSI University®

FACULTY OF BUSINESS & INFORMATION SCIENCE